MicroNet 2020

Trevor Gale[1], Erich Elsen[2], Sara Hooker[1], Olivier Temam[2], Scott Gray[3], Jongsoo Park[4], Cliff Young[1], Utku Evci[1], Niki Parmar[1], Ashish Vaswani[1].
[1]Google, [2]DeepMind, [3]OpenAI, [4]Facebook

micronet-challenge.github.io

2019 Design Philosophy

Balance accuracy & accessibility: manual scoring process, want low barrier to participation. Low barrier to innovation.

Standardized Operation Cost
All operations (add, multiply, etc.) cost the same

Freebie Quantization
Entries allowed to assume 16-bit quantization

Dynamic Activation Sparsity
Not allowed to count ReLU sparsity

Fake Quantization
Entries can evaluate with simulated quantization

Fix #1: Automated Scoring

Automated scoring libraries for popular frameworks. Increase scoring accuracy without increasing complexity of participation.

Standardize quantization evaluation. Provide ops for fake quantization with variable precision.

No freebie quantization. Frameworks have reasonable support for 16-bit storage & computation.

Allow dynamic activation sparsity. Automate counting with wrappers at evaluation time.

Fix #2: Operation Specific Costs

Operations are scored proportional to their power requirements. Factor in data movement costs from load/stores.

FP32 Matrix Multiplication (MxNxK):

$$(3.7 + 0.9) * M * N * K + 5 * (M * K + K * N + M * N)$$

Operation	Format	Precision	Power (pj)
Multiply	Floating-Point	32-bit	3.7
Multiply	Floating-Point	16-bit	1.1
Multiply	Integer	32-bit	3.1
Multiply	Integer	8-bit	0.2
Add	Floating-Point	32-bit	0.9
Add	Floating-Point	16-bit	0.4
Add	Integer	32-bit	0.1
Add	Integer	8-bit	0.03
Load/Store	8KB SRAM	64-bit	10

Figure 1: Approximate energy costs for common operations in 45nm 0.9V[1].

[1] https://ieeexplore.ieee.org/document/6757323

Extensions for 2020: Training Track

Reducing cost of training important for $$ and CO2 emissions

Even more directions and optimizations to pursue than training:

- Optimizers
- Initialization schemes
- Augmentation
- Sparse training
- Quantized training
- Transferable Lottery Tickets
- ???

Thanks!

Thanks to all the organizers for their time and help.

Thanks to all the contestants for participating and making the competition a success.

If you have thoughts about improvements for next year, please reach out to us:

eriche@google.com, tgale@google.com